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ADJUSTMENT OF THE PROPERTIES OF CERAMIC SLIPS MADE FROM POWDER MIXES PRODUCED BY THE COMPANY “CERAMIC MIXES OF DONBASS”

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The properties of slips prepared from powder mixes produced by the enterprise “Keramicheskie massy Donbassa” are shown. The application of conventional slip fluidifiers together with additives made by the Zschimmer & Schwarz Company makes it easier to adjust the properties of slip without increasing production costs.

Key words: ceramic, slip, fluidifier, properties.

The construction in Slavyansk (Ukraine, Donetsk Oblast') of the only East European plant for the production of ceramic mix — “Keramicheskie Massy Donbassa” JSC — made it possible for ceramic manufacturers to obtain high-quality ceramic mixes, reduce the costs of purchasing, storing, and processing raw materials, and reduce the cost of the contents of the slip-preparation cell, thereby decreasing the cost of producing the product. It should also be noted that the diversity of the ceramic mixes at the enterprise makes it possible to increase the product assortment.

The plant currently produces ceramic mixes for the production of porcelain, earthen tableware and decorative dishware, electrotechnical articles, souvenirs, and construction and technical ceramics. The mixes are produced in the form of dry powders for casting, in plastic form for molding, and in the form of granular powder for isostatic pressing.

Light-burning mixes containing fireclay are used for producing architectural ceramics, ceramics for use in yards and parks, and decorative ceramics. The technology used at the plant requires separate grinding of the components, high apportioning accuracy, and effective mixing.

The “Keramika Gzheli” JSC, which provides data on ceramic mixes for Russian enterprises, has accumulated a great deal of experience in using mixes. In the present article we shall examine the possibility of improving the rheological and plastic properties of slips made from ready powder mixes produced by the “Keramicheskie Massy Donbassa” JSC for the example of the mixes TFL-1, PFL-1, and MKL-1. The characteristics of these mixes are presented in Tables 1 and 2.

The process of preparing slips from these mixes is conducted in propeller mixers, less often in ball mills, and generally presents no problems. But fluctuations of the mineral composition of the product and the difference in the prepara-

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TABLE 1.

Ceramic mix	Content, wt. %								Others, %
	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	TiO ₂	CaO	MgO	K ₂ O	Na ₂ O	
TFL-1	59.5	28.2	0.34	0.45	0.3	0.2	2.2	0.4	7.2
PFL-1	67.0	21.8	0.47	0.50	0.45	0.3	1.7	0.9	6.8
MKL-1	68.0	17.5	0.55	0.50	1.9	0.9	2.2	2.0	5.6

TABLE 2.

Indicator	Ceramic mix		
	TFL-1	PFL-1	MKL-1
Residue on 63 μm sieve, %, not greater than	1.1 – 1.4	2.0	3.0
Dry-state ultimate strength, MPa, not less than	3.0	3.0	3.0
Total shrinkage, %, not greater than	15.0	13.0	6.0
Water absorption, %, not greater than	0.2	0.2 – 4.0	17.0
Calcination temperature, $^{\circ}\text{C}$	1320 – 1360	1180 – 1260	1050 – 1080

TABLE 3.

Fluidifier	Fluidity (Engler viscosimeter), sec		Thickening factor
	after 30 sec	after 30 min	
0.17%* Na_2SiO_3 + 0.07% Na_2CO_3	15	25	1.67
0.17% Na_2SiO_3 + 0.07% Na_2CO_3 + 0.002% DOLAPIX PC 67	13	19	1.46
0.17% Na_2SiO_3 + 0.07% Na_2CO_3 + 0.002% DOLAPIX G 10	12	18	1.50
0.17% Na_2SiO_3 + 0.07% Na_2CO_3 + 0.002% DOLAPIX DH 6	15	23	1.57

* Content, wt. %

tion conditions make it necessary to adjust the rheological and plastic properties of the slips obtained.

The advantages of slips made from powder mixes are high cast acquisition rate and drying of the green material in a gypsum mold. But the plastic properties of the casts differ from those of slips prepared by the conventional scheme (cast break-off).

To improve the properties of slip prepared from powder mixes, the technology group at “Keramika Gzheli” JSC has introduced the following measures into practice: decreasing the amount of soda in the composition of the deflocculants, decreasing the moisture content of the slip, and adding 2 – 3% white-burning refractory clays. Higher clay content can lower the whiteness of the articles [1].

Additives produced by the Zschimmer & Schwarz Company (Germany) were used to adjust the rheological properties of slip. Dispersing agents and fluidifiers were tested: DOLAPIX G 10 and DOLAPIX PC 67 based on sodium salt of polycarbonic acids; DOLAPIX DH 6 based on polyamino polycarboxylate; DOLAFLUX SP NEU based on huminates and silicates. The use of only inorganic substances (for example, conventional calcinated soda and soluble sodium glass) as fluidifiers does not always give the required im-

provements of filtration and cast separation from a mold. For this reason, it is more effective to use them in combination with other deflocculants consisting of salts of mineral and organic acids [2]. Tests performed on slips made from power mixes (TFL-1, PFL-1) established the following:

- a considerable increase of fluidity and decrease of thickening even with very small quantities (0.006 – 0.002%) of the additives DOLAPIX G 10 and DOLAPIX PC 67 (Table 3);

- increase of the filtration rate and easier separation of the cast from the mold with introduction of DOLAPIX G 10, DOLAPIX PC 67, and DOLAPIX DH 6;

- good compatibility of the additives indicated above with calcinated soda and soluble glass.

These additives also improved the rheological properties of slips prepared from mixes with the addition of casting wastes and water with variable hardness. DOLAFLUX SP NEU made it possible to obtain slip with good characteristics from earthen mixes with high clay content which are difficult to fluidify.

The testing performed shows that additives made by the Zschimmer & Schwarz Company can be used to adjust the properties of slips prepared from ceramic mixes and conventional inexpensive fluidifiers (soluble glass and calcinated soda). The precise amount of additives is determined experimentally. We note that these additives do not increase production costs.

In conclusion, we note that the combined work performed by “Keramicheskie Massy Donbassa” JSC and “Keramiki Gzheli” JSC on expanding the assortment of ready ceramic mixes and improving their properties will be continued. This will aid manufacturers of ceramics to produce products which are competitive on the world market.

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